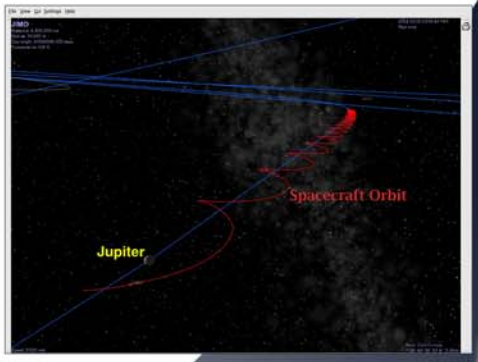
Adaptive Control Technologies

NASA Ames Research Center Computational Sciences Division

The main focus of the Adaptive Control Technologies group at NASA Ames Research Center is to develop, implement, and test next generation control architectures that enable rapid prototyping of adaptive intelligent controllers. Intelligent control architectures rely on nature-inspired, mathematically sound problem solving tools to adaptively arrive at control solutions in the midst of uncertainties and failures. Current research includes:



• Neural networks - These are brain inspired models that consist of many similar linear and nonlinear computational elements connected in patterns.? The simple computational elements, also known as neurons, when associated in complex patterns, have the ability to perform tasks such as memory recall, pattern recognition, and learning.

• Adaptive critic architectures? -- Adaptive critic designs have been defined as designs that attempt to approximate dynamic programming based on the principle of optimality. Adaptive critic designs consist of two entities, an action network that produces optimal actions and an adaptive critic that estimates the performance of the action network.

• Neural adaptive control -- The neural network based approach incorporates direct adaptive control with dynamic inversion to provide consistent handling qualities without requiring explicit system identification.

• Artificial Immune Systems (AIS) -- AIS combine current knowledge with the adapting capabilities of biological immune systems to provide a powerful alternative to currently available techniques for pattern recognition, modeling, design, and control.

ACT Current applications include:

- Damage adaptive control for large transport aircraft
- Adaptive Low Thrust Trajectories for space trajectory applications
- Adaptive flow control for low-emission engines
- Adaptive distributed combustion control
- Intelligent control for a fly back booster

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